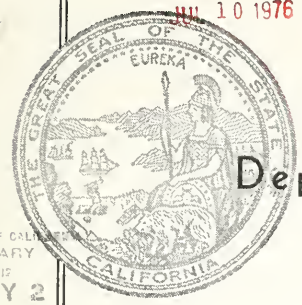
UCD LIBRARY

JUL 10 1976

PHYSICAL SCIENCES LIBRARY



THE RESOURCES AGENCY OF CALIFORNIA

Department of Water Resources

UNIV. OF CALIFORNIA LIBRARY DAVIS COPY 2
JUL 29 1972
30 REC'D

BULLETIN No. 16-63

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

OCTOBER 1, 1962—SEPTEMBER 30, 1963

UNIVERSITY OF CALIFORNIA
DAVIS
NOV 20 1964
LIBRARY

JUNE 1964

HUGO FISHER
Administrator
The Resources Agency of California

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources

State of California

THE RESOURCES AGENCY OF CALIFORNIA

Department of Water Resources

BULLETIN No. 16-63

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

OCTOBER 1, 1962—SEPTEMBER 30, 1963

JUNE 1964

HUGO FISHER
Administrator
The Resources Agency of California

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources

ERRATA SHEET TO BULLETIN NO. 16-63
WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
OCTOBER 1962-SEPTEMBER 1963

The following corrections should be made on Bulletin No. 16-63:

1. Page 6, Table 2 - under Project No. 12-63-1 in the "Client" column, "County of Kern and County of Tulare" change to "County of Kern".
2. Page 6, Table 2 - under Project No. 12-63-1 in the "Target Area" column, "Eastern Tulare County and Kern County" should be changed to "Kern River Watershed and Northwest Corner of Kern County".

UNIVERSITY OF CALIFORNIA
DAVIS
JAN 15 1965
LIBRARY

TABLES OF CONTENTS

Page

LETTER OF TRANSMITTAL v

INTRODUCTION 1

SUMMARY OF OPERATIONS 2

TABLES

Table Number

1 ACTIVE WEATHER MODIFICATION LICENSES DURING THE PERIOD OCTOBER 1962 THROUGH SEPTEMBER 1963 . . . 5

2 WEATHER MODIFICATION OPERATIONS IN CALIFORNIA, OCTOBER 1, 1962 - SEPTEMBER 30, 1963 6

APPENDIX

CHAPTER 4, DIVISION 1, OF THE WATER CODE. . . . 7

PLATES

Plate Number

1 APPROXIMATE TARGET AREA OF WEATHER MODIFICATION OPERATIONS, 1962-63 13

2 CALENDAR OF WEATHER MODIFICATION OPERATIONS OCTOBER 1962 THROUGH SEPTEMBER 1963 15

STATE OF CALIFORNIA—RESOURCES AGENCY

WILLIAM E. WARNE, *Director*

DEPARTMENT OF WATER RESOURCES

P.O. BOX 388

SACRAMENTO

May 4, 1964

Honorable Edmund G. Brown, Governor
and Members of the Legislature of the
State of California

Gentlemen:

I have the honor to transmit herewith a report of the Department of Water Resources, entitled "Weather Modification Operations in California, October 1, 1962 - September 30, 1963."

During the period covered by the report, there were ten projects involving weather modification operations which were undertaken in California. These were accomplished by nine of the eleven operators who were licensed by the department for such activities.

Sincerely yours,

William E. Warne

Director

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
OCTOBER 1, 1962 - SEPTEMBER 30, 1963

INTRODUCTION

This report presents a summary of all weather modification projects conducted in California during the period October 1, 1962, through September 30, 1963, as reported to the Department of Water Resources in accordance with the provisions of Chapter 4, Division 1 of the Water Code.

Appended to this report are the statutes on the regulation and control of natural precipitation by artificial means.

These statutes provide in part that:

> "No person, without first securing a license from the department, shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere."

On being issued a license by the department, the licensee may operate projects in the areas and periods specified in the notices of intention to modify natural precipitation by artificial means. These notices must be published by the licensee in newspapers having a general circulation and published in each county where the operation is to be conducted. At the conclusion of each weather modification project, the licensee is required by law to submit a completion report to the Department of Water Resources. These reports include such information as the name of the agency sponsoring the project, location of the project, log of all seeding operations,

cloud-seeding techniques and type of equipment used, and the names of all persons who assisted in the operation. These completion reports are summarized by the department in an annual report on weather modification operations in California. This is the eighth report published in this series which summarizes completion reports submitted to the department since July 1952.

A detailed report which presents the theory of weather modification, evaluation of methods and results, and a history of cloud-seeding operations from July 1947 through June 1952 was published by the State Water Resources Board in June 1955 as Bulletin No. 16, "Weather Modification Operations in California."

SUMMARY OF 1962-63 OPERATIONS

During the period October 1962 through September 1963, ten weather modification operations were conducted in California from Plumas County in the north to San Diego County in the south. Of the ten cloud-seeding projects, nine were for the stated purposes of increasing precipitation, and one was for suppressing hail. Five of these operations were concentrated along the western slope of the Sierra Nevada Mountains, and one was concentrated in the Central Coast Range for the purpose of increasing precipitation on watersheds above water conservation reservoirs or hydroelectric installations. Precipitation increase was also the purpose of the three seeding projects in Southern California. The single hail suppression project covered most of the lower Sacramento Valley. Approximate areas affected by cloud-seeding operations during 1962-63 are shown on Plate 1.

The year covered by this report was one of the better water supply seasons of recent history. A major portion of the total rainfall, which approached or exceeded the 50-year average in most areas, fell during the months of October, March, and April. Even though clouds with rain producing potential were available for only relatively short periods, paralleling the weather of the 1961-62 season, the total number of days in which seeding took place increased by 46.

During the 1962-63 season, ten projects were conducted by nine licensees. The total operating time of ground based generators on these projects was 23,952 hours. Nine operators used silver iodide as a nucleating agent for ground based generators, and one used non-toxic metallic haloids in an experimental project. Dry ice (solidified carbon dioxide) and silver iodide were used in airborne generators in four of the projects. During this period an estimated 390,653 grams, or 861 pounds, of silver iodide, 3,527 pounds of haloids, and 4,576 pounds of "dry ice" were released.

The amount of silver iodide released during the 1962-63 season was 176 percent of that released during the 1961-62 season. Total operating time during the 1962-63 season was 151 percent of the previous season's. Of the 365 calendar days during the year covered by this report, seeding operations were conducted on 133 days, as opposed to 87 days for the 1961-62 season.

During the period covered by this report, no licenses expired, and License No. 25 was issued to KRC Service Corporation.

Table 1 lists all licenses which were active during the 1962-63 period.

Projects conducted in California during the 1962-63 season are listed in Table 2, together with pertinent data on number of generator-hours, rate of use of silver iodide, etc. Each project in the table is designated by a coding number consisting of three elements. The first element is the license number, the second indicates the water year, and the third is assigned in numerical sequence to projects undertaken by a licensee during the year as shown by published notices of intention filed with the department. This code number is used to identify the project for which the approximate target areas are shown on Plate 1 and for which the daily cloud-seeding operations are shown on Plate 2.

TABLE 1

ACTIVE WEATHER MODIFICATION LICENSES
DURING THE PERIOD OCTOBER 1962 THROUGH SEPTEMBER 1963

License Number	Licensee
1	North American Weather Consultants Santa Barbara Municipal Airport Goleta, California
5	Water Resources Development Corporation 460 South Broadway Denver 9, Colorado
6	Weather Modification Company San Jose Municipal Airport San Jose 10, California
12	Precipitation Control Company of California 105 Pierce Street Taft, California
14	North American Weather Consultants of California Santa Barbara Municipal Airport Goleta, California
18	Los Angeles County Flood Control District Box 2418, Terminal Annex Los Angeles 54, California
21	Atmospherics Incorporated 3435 East Pontiac Way Fresno 3, California
22	San Bernardino Valley Municipal Water District 355 North "D" Street San Bernardino, California
23	Pacific Gas and Electric Company 245 Market Street San Francisco 6, California
24	International Weather Control, Inc. 40 West First Street, Suite 105 Reno, Nevada
25*	KRC Service Corporation 2956 C Street San Diego 2, California

* License issued July 9, 1963

TABLE 2

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
OCTOBER 1, 1962 - SEPTEMBER 30, 1963

Project number	Licensee	Client	Target area	Period of operation	Rate of use of silver iodide in grams per hour: Ground-based	Rate of use of silver iodide in grams per hour: Air-borne	Total generator-hours: Ground	Total generator-hours: Air	Purpose
5-63-1	Water Resources Development Corporation	Placer County Farm Labor Cooperative	Parts of Placer, Nevada and El Dorado Counties	Mar. 7, 1963 June 15, 1963	19.0(a)		12,475.5		Hail suppression
6-63-1	Weather Modification Company	Santa Clara Valley Water Conservation District	Santa Clara County	Nov. 1, 1962 Apr. 1, 1963	15.1(a)	45	1,232.75	20.25	Precipitation increase
12-63-1	Precipitation Control Company of California	County of Kern and County of Tulare	Eastern Tulare County and Kern County	Oct. 15, 1962 May 31, 1963		43		95.2	Precipitation increase
14-63-1	North American Weather Consultants of California	Southern California Edison Company	Upper San Joaquin River Basin	Oct. 1, 1962 Sept. 30, 1963	6.7		3,797.2		Precipitation increase
18-63-1	Los Angeles County Flood Control District	Los Angeles County Flood Control District	Drainage area above San Gabriel Dam	Nov. 15, 1962 May 14, 1963	6.0		602.3		Precipitation increase
21-63-1	Atmospherics Incorporated	Kings River Conservation District	Kings River Basin above Pine Flat Reservoir	Oct. 1, 1962 May 15, 1963	10	(b)	2,400.8	51.7	Precipitation increase
21-63-2	Atmospherics Incorporated	County of Tulare	Tulare County	Nov. 1, 1962 May 15, 1963		(c)		80.3	Precipitation increase
22-63-1	San Bernardino Valley Municipal Water District	San Bernardino Valley Municipal Water District	Santa Ana River Watershed	Sept. 15, 1962 June 1, 1963	20.6		1,349		Precipitation increase
23-63-1	Pacific Gas and Electric Compaoy	Pacific Gas and Electirc Company	Lake Almanor-Butt Lake drainage area	Nov. 15, 1962 May 31, 1963	26.0		1,849.5		Precipitation increase
25-63-1	KRC Service Corporation	Vista Irrigation District	Lake Henshaw Watershed San Diego County	Aug. 1, 1963 Dec. 20, 1963	14.4 (lbs.)(d)		244.9		Precipitation increase

(a) Estimated weighted mean.
(b) This operator used dry ice (CO_2 crystals) in place of silver iodide for air-borne operations. Total dry ice used was 2,685 pounds.
(c) This operator used dry ice (CO_2 crystals) and silver iodide for air-borne operation. Rate not given. Total dry ice used was 1,891 lbs. and total silver iodide used was 1,060 grams.
(d) Amounts dispersed on or before September 30, 1963. This was a research project where assorted non-toxic metallic haloids were used experimentally. Specific agents were not indicated for proprietary reasons.

CHAPTER 4, DIVISION 1 OF THE WATER CODE

CHAPTER 4, DIVISION 1 OF THE WATER CODE, STATE OF CALIFORNIA

REGULATION OF RAIN-MAKING AND RAIN-PREVENTION

(Chapter 4 added by Stats. 1953, Ch. 139, as part of codification)

400. The public interest, health, safety, welfare, and necessity require that scientific experimentation in the field of artificial nucleation, and that scientific efforts to develop, increase, and regulate natural precipitation be encouraged, and that means be provided for the regulation and control of interference by artificial means with natural precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, within the State, in order to develop, conserve, and protect the natural water resources of the State and to safeguard life and property.

401. As used in this chapter:
(a) "Department" means the Department of Water Resources.
(b) "Person" means any person, firm, association, organization, partnership, company, corporation, private or public, county, city, city and county, district, or other public agency. (Amended by Stats. 1959, Ch. 1269)

402. No person, without first securing a license from the department, shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture or water in any form contained in the atmosphere.

403. Any person desiring to do any of the acts specified in Section 402 may file with the department an application in writing for a license. Each application shall be accompanied by a filing fee fixed by the department with the approval of the Department of Finance but not to exceed fifty dollars ($50) and shall be on a form to be supplied for such purpose by the department.

404. Every application shall set forth all of the following:
(a) The name and post-office address of the applicant.
(b) The previous education, experience, and qualifications of the applicant, or, if the applicant is other than an individual, the previous education, experience, and qualifications of the persons who will be in control of and charged with the operations of the applicant.
(c) A general description of the operations which the applicant intends to conduct and the method and type of equipment that the applicant proposes to use.

(d) Such other pertinent information as the department may require.

405. Upon the filing of the application upon a form supplied by the department and containing the information prescribed by this chapter and accompanied by the required filing fee the department shall issue a license to the applicant entitling the applicant to conduct the operations described in the application for the calendar year for which the license is issued, unless the license is sooner revoked or suspended.

406. A license may be renewed annually upon application to the department, accompanied by a renewal fee fixed by the department with the approval of the Department of Finance but not to exceed twenty-five dollars ($25), on or before the last day of January of the calendar year for which the license is renewed.

407. Prior to undertaking any operation authorized by the license the licensee shall file with the department and cause to be published a notice of intention. The licensee shall then confine his activities for that operation substantially within the time and area limits set forth in the notice of intention.

408. The notice of intention shall set forth all of the following:

(a) The name and address of the licensee.

(b) The nature and object of the intended operation and the person or persons on whose behalf it is to be conducted.

(c) The area in which and the approximate time during which the operation will be conducted.

(d) The area which will be affected by the operation as near as the same may be determined in advance.

409. The licensee shall cause the notice of intention to be published pursuant to Section 6063* of the Government Code in a newspaper having a general circulation and published within any county wherein the operation is to be conducted and in which the affected area is located, or, if the operation is to be conducted in more than one county or if the affected area is located in more than one county or is located in a county other than the one in which the operation is to be conducted, then such notice shall be published in like manner in a newspaper having a general circulation and published within each of such counties. In case there is no newspaper

* A copy of Government Code Section 6063 is appended to this excerpt from the Water Code.

published within the appropriate county, publication shall be made in a newspaper having a general circulation within the county. (Amended by Stats. 1955, Ch. 482, and by Stats. 1957, Ch. 448)

410. Proof of publication shall be filed by the licensee with the department within 15 days from the date of the last publication of the notice. Proof of publication shall be by copy of the notice as published attached to and made a part of the affidavit of the publisher or foreman of the newspaper publishing the notice.

411. Every licensee shall keep and maintain a record of all operations conducted by him pursuant to his license showing the method employed, the type of equipment used, the times and places of operation of the equipment, the name and post-office address of each person participating or assisting in the operation other than the licensee, and such other information as may be required by the department, and shall report the same to the department immediately upon the completion of each operation.

412. Each licensee shall further prepare and maintain an evaluation statement for each operation which shall include a report as to estimated precipitation, defining the gain or loss occurring from nucleation activities, together with supporting data therefor. This statement, together with such other pertinent information as the department may require, shall be sent to the department upon request by the department.

413. Notwithstanding any provision of this chapter to the contrary, the department may grant a licensee permission to undertake an emergency nucleation project, without compliance by the licensee with the provisions of Sections 407 to 410, inclusive, if the same appears to the department to be necessary or desirable in aid of extinguishment of fires.

413.5. Notwithstanding any provision of this chapter to the contrary, upon request of the board of supervisors of a county or of the governing body of a city or a public district of the State, and upon the submission of such supporting evidence as the department may require, the department may grant a licensee permission to undertake a nucleation project for the purpose of alleviating a drought emergency, without prior compliance by the licensee with the provisions of Section 407 requiring publication of notice of intention, if such project appears to the department to be necessary or desirable. Nothing contained in this section shall be construed as to relieve the licensee in such case from compliance with the provisions of Sections 407 to 410, inclusive, requiring publication of notice of intention and filing of proof of such publication, as soon after the granting of permission by the department as is practicable. (Added by Stats. 1955, Ch. 1399)

414. Any license may be revoked or suspended if the department finds, after due notice to the licensee and a hearing thereon, that the licensee has failed or refused to comply with any of the provisions of this chapter. The proceedings herein referred to shall be conducted in accordance with the provisions of the Administrative Procedure Act, Chapter 5, Part 1, Division 3, Title 2 of the Government Code and the department shall have all the powers granted therein.

415. Any person who violates any provision of this chapter is guilty of a misdemeanor.

NOTE

The foregoing is a true copy of Chapter 4, Division 1 of the Water Code as of 1/1/61. Persons directly concerned with any activities coming under the provisions of this chapter are urged to check with the department from time-to-time for any revisions that may be made by the Legislature.

For convenience of those persons interested in publication requirements for notices of intention, the following is a copy of Section 6063 of the Government Code.

6063. Publication of notice pursuant to this section shall be once a week for three successive weeks. Three publications in a newspaper regularly published once a week or oftener, with at least five days intervening between the respective publication dates not counting such publication dates, are sufficient. The period of notice commences upon the first day of publication and terminates at the end of the twenty-first day, including therein the first day. (Added by Stats. 1949, Ch. 1587; amended by Stats. 1957, Ch. 1670, and by Stats. 1959, Ch. 954)

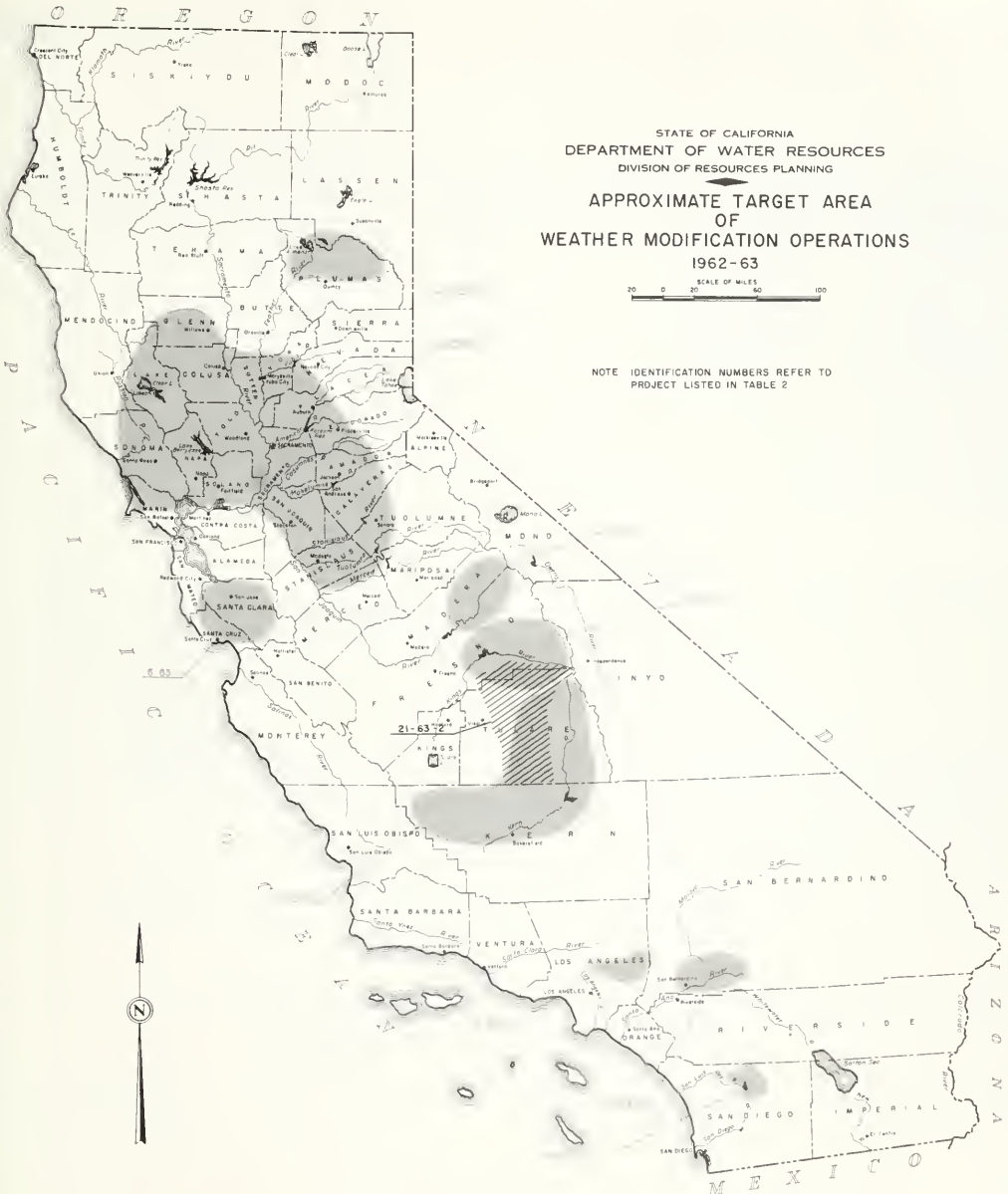
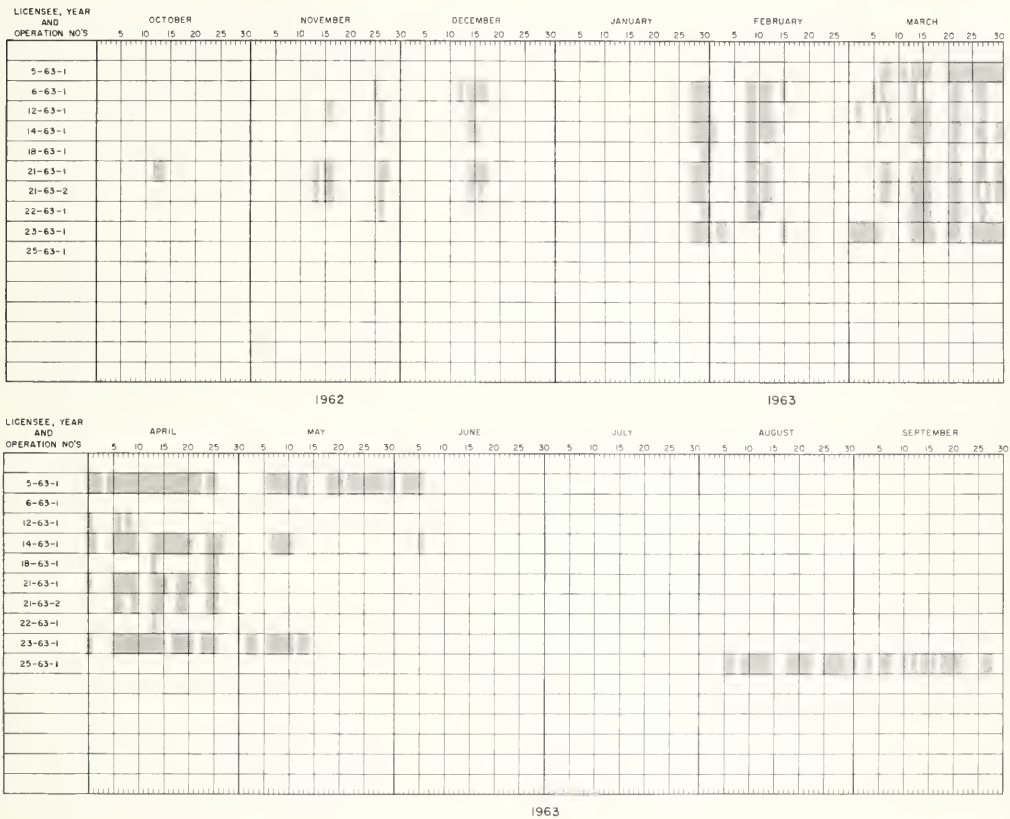

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
APPROXIMATE TARGET AREA
OF
WEATHER MODIFICATION OPERATIONS
1962-63
SCALE OF MILES
20 0 20 60 100
NOTE IDENTIFICATION NUMBERS REFER TO PROJECT LISTED IN TABLE 2
21-63-2
6-63
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
LAKE
COLUSA
YUBA
NEVADA
PLACER
SONOMA
NAPA
SOLANO
SACRAMENTO
EL DORADO
ALPINE
AMADOR
CALAVERAS
MARIN
CONTRA COSTA
SAN FRANCISCO
ALAMEDA
TUOLUMNE
MONO
SAN JOAQUIN
STANISLAUS
MARIPOSA
MERCED
SANTA CLARA
SANTA CRUZ
SAN BENITO
MADERA
FRESNO
INYO
MONTEREY
KINGS
TULARE
KERN
SAN LUIS OBISPO
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
N

PLATE 2



CALENDAR OF WEATHER MODIFICATION OPERATIONS

OCTOBER 1962 THROUGH SEPTEMBER 1963

DAYS OF CLOUD SEEDING SHOWN IN GRAY

DEPARTMENT OF WATER RESOURCES 1962

Harvard

THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW

BOOKS REQUESTED BY ANOTHER BORROWER
ARE SUBJECT TO RECALL AFTER ONE WEEK.
RENEWED BOOKS ARE SUBJECT TO
IMMEDIATE RECALL

RECEIVED PSI

MAR 2 0 1992

LIBRARY, UNIVERSITY OF CALIFORNIA, DAVIS

D4613 (12/76)

UNIVERSITY OF CALIFORNIA DAVIS
3 1175 02037 6706

TC
824
C2
A2
no.16:62-72

PHYSICAL
SCIENCES
LIBRARY

California. Dept. of Water Resources.
Bulletin.